43rd COSPAR Scientific Assembly 2020

Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
Science Enabled by a Lunar Outpost (B3.2)
Consider for oral presentation.

BIOLEX – THE BIOLOGY AND LUNAR EXPERIMENT AND THE LOGOS CUBES

Dr. Jean-Pierre De Vera, jean-pierre.devera@dlr.de
German Aerospace Center, Berlin, Germany
BIOLEX-LOGOS Team
M. Baqué, A. Lorek, T., German Aerospace Center (DLR), Institute of Planetary Research, Management and Infrastructure, Research Group Astrobiological Laboratories, Rutherfordstr. 2, 12489 Berlin, Germany Mickael.Baque@dlr.de, Andreas.Lorek@dlr.de, T. Berger, C.E. Hellweg, R. Möller, DLR, Institute of Aerospace Medicine, Linder Höhe, 51147 Köln, Germany, Thomas.Berger@dlr.de, jens.hauslage@dlr.de, Christine.Hellweg@dlr.de, Ralf.Moeller@dlr.de, J. Hauslage, D. Billi, Department of Biology, Laboratory of Astrobiology and Molecular Biology of Cyanobacteria from Extreme Environments, University of Rome Tor Vergata, Rome, Italy, billi@uniroma2.it, U. Böttger, F. Hanke, S. Schröder, DLR, Institute of Optical Sensor Systems, Rutherforfstr. 2, Berlin, Germany, ute.boettger@dlr.de,Franziska.Hanke@dlr.de, Susanne.Schroeder@dlr.de, C.S. Cockell, School of Physics and Astronomy, University of Edinburgh, James Clerk Maxwell Building, Peter Guthrie Tait Road, Edinburgh, EH9 3FD, UK, c.s.cockell@ed.ac.uk, R. de la Torre Noetzel, Instituto Nacional de Técnica, Aeroespacial, INTA, Dpo. Observación de la Tierra, Area de Investigación e Instrumentación Atmosférica, Crta. Ajalvir, km. 4, Torrejón de Ardoz, 28850-Madrid, Spain, torrenr@inta.es, R. Demets, B. Foing, ESA/ESTEC, Noordwijk, The Netherlands, Rene.Demets@esa.int,Bernard.Foing@esa.int, A. Elsaesser, Experimental Molecular Biophysics, Free University of Berlin, Arnimallee 14, 14195 Berlin, Germany, a.elsaesser@fu-berlin.de, F. Foucher, F. Westall, Centre de Biophysique Moléculaire, CNRS, Orléans, France, frederic.foucher@cnrs.fr, frances.westall@cnrs-orleans.fr, T. Herzog, TH-Wildau, Hochschulring 1, 15745 Wildau, Germany, thomas.herzog@th-wildau.de, J. Joshi, Biodiversity Research/Systematic Botany, University of Potsdam, Maulbeerallee 1, 14469 Potsdam, Germany, jjoshi@uni-potsdam.de, N. Kozyrovska, Institute of Molecular Biology & Genetics of NASU, Kyiv, Ukraine, kozyrna@ukr.net, P. Lasch, Robert Koch-Institute, ZBS 6 - Proteomics and Spectroscopy, Nordufer 20, 13353 Berlin, Germany, LaschP@rki.de, T. Leya, Arbeitsgruppe Extremophilenforschung & Biobank CCCryo, Zellfreie und Zellbasierte Bioproduktion, Fraunhofer-Institut für Zelltherapie und Immunologie, Institutsteil Bioanalytik und Bioprozesse IZI-BB, Am Mühlenberg 13, 14476 Potsdam, Germany, thomas.leya@izi-bb.fraunhofer.de, K. Olsson-Francis, School of Environment, Earth and Ecosystem Sciences The Open University Milton Keynes, MK7 6AA, UK, Karen.Olsson-Francis@open.ac.uk, S. Onofri, Dipartimento di, Scienze Ecologiche e Biologiche, Università della Tuscia, 01100 Viterbo, Italy, onofri@unitus.it, L. García-Sancho, Departamento de Biología Vegetal II, Complutense University of Madrid, Spain, sancholg@farm.ucm.es, D. Schulze-Makuch, Center of Astronomy

and Astrophysics, Technical University of Berlin, 10623 Berlin, Germany, schulze-makuch@tu-berlin.de, D. Wagner, Section Geomicrobiology, GFZ German Research Centre for Geosciences, 14473 Potsdam, Germany, dwagner@gfz-potsdam.de

BIOLEX is a concept designed for in situ science on the Moon or in its orbit. As heritage of the polar and space experiment BIOMEX (Biology and Mars Experiment) on the ISS it is a more developed concept. Measurement operations on an exposure platform as well as within a micro-greenhouse device are part of this concept. The goal is to investigate the use of lunar resources as well as to analyse the stability of biomolecules as potential biosignatures serving as reference for future space exploration missions to Mars and the icy ocean moons in the outer solar system. Astrobiological exploration of the solar system is a priority research area such as emphasized by the European Astrobiology Roadmap (AstRoMap). It is focusing on several research topics, such as "Habitability" and on "Biomarkers for the detection of life". Therefore, "space platforms and laboratories", such as the EXPOSE setup installed outside the ISS, are essential to gain more knowledge on space- and planetary environments, which might be an essential basis for improvement of the robotic and human interplanetary exploration (Moon, Mars, Encedalus, Titan and Europa). In reference to these exposure platforms a new generation of hardware is needed to be installed in the lunar orbit or directly on the Moon. The BIOLEX is representing by its LOGOS (Lunar Organisms, Geo-microbiology and Organics Space Experiment) cubes such a concept combining the life detection topics with topics relevant to autonomous life supporting systems. A combination of a sample exposure device and a micro-habitat for plants and microorganisms could address a tremendous number of questions from astrobiology and life sciences. The main scientific objectives for the use of BIOLEX-LOGOS cubes are: (i) in situ measurements by spectroscopy methods (such as Raman, IR, UV/VIS-spectroscopy) for analysis of biosignatures and their stability what is relevant for support of future life detection missions on Mars and the icy moons in the outer solar system); (ii) in situ measurements of environmental conditions (radiation, pressure/vacuum, temperature, pH, humidity) in micro-modules or compartments in reference to planned micro-habitat experiments placed on the Moon or incorporated on an exposure facility in orbit; (iii) in situ measurements of microorganisms' activity in micro-modules / compartments in reference to planned micro-habitat experiments placed on the moon or incorporated in the exposure facility in orbit. In reference to these scientific ideas the Moon is an excellent platform to operate different space experiments which will be of relevance for astrobiology, life sciences and human space missions. BIOLEX tries to fulfil a large number of scientific investigations in reference to these disciplines. The lunar environment is much harsher compared to Mars; and tests on biomolecules in this environment could provide information on their stability and therefore on the value to be used as reference for future space missions to Mars or the icy ocean moons in the outer solar system. Resources of the Moon such as the regolith or the freely available radiation on the surface could be tested by using them in a micro-greenhouse. Within this greenhouse different filters could test the optimal spectra range of the radiation.